FOSSIL OAK WOOD FROM THE BRITISH EOCENE

by DONALD W. BRETT

ABSTRACT. The circumscription of the organ-genus *Quercinium* Unger is discussed in relation to the wood structure of the Recent oaks and emended so as to include fossil wood conforming to the wood of the living species of *Quercus* L. and *Lithocarpus* Blume, since the wood of these genera is anatomically indistinguishable. *Quercinium quercoides* (Goepp.) Edwards is designated type species, and the name *Quercinium* Unger recommended as a *nomen conservandum* against the earlier valid name *Kloedenia* Goeppert. Two fossil woods, each with a type of structure found today in species of tropical evergreen oaks, are described and figured: *Quercinium porosum* sp. nov. from the Woolwich Beds (Landenian), Herne Bay, Kent; *Quercinium pasanioides* sp. nov. from the London Clay (Ypresian), near Ipswich, Suffolk.

FOSSIL wood resembling that of recent *Quercus spp.* has generally been referred to the genus *Quercinium* Unger (1842). Unger based this genus upon three very briefly described specimens of fossil wood which agreed in gross structure with the wood of oaks of the ring porous type with rays of two distinct sizes: 'Ligni strata concentrica distincta. Radii medullares biformes ("heteromorphi" in Unger 1850) . . . Vasa porosa . . . in uno v. in duobus stratis coacervata, in reliquis multo minora, fasciculatim aggregata.' The diagnosis was emended slightly by Mercklin (1855) who added a description of the wood parenchyma.

Felix was the first to deviate much from the original circumscription of the genus when he described under *Quercinium* a species, *Q. knowltoni*, in which the pores decrease in size gradually through the growth ring (Felix 1896). In this respect it resembled a wood previously described by Conwentz as *Quercites transiens*. Subsequent authors have used *Quercinium* as 'merely a form-genus for fossil wood closely resembling the recent *Quercus*' (Edwards 1931, p. 66), with neither type species nor generic diagnosis. Unfortunately a situation similar to this exists in respect of many genera created for fossil wood of dicotyledons. Furthermore, *Quercinium* is to be regarded as an organ-genus since its affinity with the Recent oaks is undoubted.

It would in fact be impracticable to restrict the genus to Unger's diagnosis since the growth ring in the wood of *Quercus* and allied genera is very variable, and all grades occur between ring porous and diffuse porous types, with and without a seasonal decrease in pore size. It is equally certain that this organ-genus cannot be regarded as comprising fossil wood of *Quercus* alone.

The major trends of specialization in the structure of the wood of the oaks appear to be closely associated with the differentiation of the growth ring with distinct early and late wood, and parallel grades are to be found in each of the large genera *Castanopsis* Spach., *Lithocarpus* Blume, and *Quercus* L.

The boundary of the growth ring is often difficult to trace in species from the humid tropical regions but in many evergreen oaks from temperate regions the ring is clearly marked by a more or less gradual diminution in diameter of the vessels in the late wood. In the truly ring porous types the radial pattern, which is a characteristic feature of transverse sections of wood throughout the oak–chestnut alliance, is often altogether lost

[Palaeontology, Vol. 3, Part 1, 1960, pp. 86–92, pls. 21–22.

from the early wood and the large pores of this zone form a tangentially continuous ring. In many species of *Quercus*, where this is the mature arrangement, the first few rings of secondary wood possess the radial, diffuse porous pattern.

Examination of a large number of ring porous woods led Metcalfe and Chalk (1950) to conclude that 'it would appear unwise . . . to rule out the possibility that ring porousness may represent an ecological specialization, which occurs in wood at very different levels of general specialization and in widely separated taxonomic groups' (op. cit., p. xlviii). The oaks furnish an instructive illustration of a trend to ring porousness within several closely related species groups, which has apparently gone hand in hand with their general adaptive radiation from tropical centres.

The wood rays are basically of two distinct sizes in the Fagaceae but, as in *Castanea* and *Nothofagus*, specialization has led to the elimination of the very broad rays from *Castanopsis*, and a few species of *Lithocarpus*, e.g. *L. fenestratus* (Roxb.) Rehd., *L. pachyphyllus* (Kurz) Rehd. (Gamble 1881), *L. lappaceus* (Roxb.) Rehd. (Gamble 1881; Tippo 1938), and *L. sieboldii* (Makino) Nakai (Metcalfe and Chalk 1950). Broad rays may also be absent from the young stems and branches of several *Quercus spp.*

Wood parenchyma, typically banded in the oaks, may vary between individual species from regular and continuous bands of one to four cells in radial extent to discontinuous and wavy tangential strings of cells, in some forming a sort of reticulate arrangement and in yet others the parenchyma is rare and diffuse. In some *Quercus spp.* at least there is considerable variation between different samples and this appears often to be related to the width of the growth rings.

CIRCUMSCRIPTION OF THE ORGAN-GENUS

Fossil wood ascribable to the recent *Castanea* and *Castanopsis* will be excluded from the organ-genus *Quercinium* if this latter be restricted to wood with rays of two distinct sizes.

The two genera *Lithocarpus* and *Quercus* are not distinguishable on the basis of wood anatomy alone. Types of structure found in one genus grade insensibly into those of the other at all levels of specialization of the growth ring. The evergreens in the genus *Quercus* have wood indistinguishable from that of many species of *Lithocarpus*, and it would hardly be possible to distinguish the ring porous wood of *L. uraianus* (Hay.) Hay., for example, from many other *Q. alba*-type woods.

I propose to emend the organ-genus *Quercinium* to include fossil wood conforming to that of the Recent genera *Quercus* L. and *Lithocarpus* Blume. The two new species described in this paper have a structure found today in species of evergreen oaks from the tropics, and are thus included in the organ-genus as now understood.

Family FAGACEAE
Organ-genus QUERCINIUM Unger

Emended diagnosis. Fossil secondary wood, or stems or roots with some secondary wood. Rays of two distinct sizes; uniseriate rays numerous, multiseriate rays often very broad and high and appearing compound or aggregate. Wood parenchyma commonly in tangential bands or strings, but may be diffuse. Vessels mostly large and solitary

except in the late wood of ring porous species, and showing some radial pattern in transverse sections; often accompanied by tracheids (vasicentric); vessel members with simple perforations, exceptionally scalariform when very narrow; intervascular pitting alternate to sub-opposite. Ray to vessel pits large, gash-like, usually vertically or obliquely elongated. Remainder of wood tissue of fibre-tracheids and/or fibres.

Type species. The selection of a type species for *Quercinium* is desirable since one has never been designated. The three species originally included in the genus by Unger (1842) were given such inadequate description that it would be impossible to recognize any of them again, and the specimens do not appear to have been preserved. At that time, however, Unger observed that *Kloedenia quercoides* Goeppert (1839) could probably be included in *Quercinium*, and in 1845 he cited this earlier name as synonymous with *Quercinium sabulosum*, one of his three original species, ignoring the priority of Goeppert's name. Thus, on Unger's own admission, *Q. sabulosum* may be accepted as a synonym of *K. quercoides*. Meanwhile Goeppert had described another specimen apparently identical with his *Kloedenia* material, under a new name *Quercites primaevus* Goeppert (1845), abandoning completely his previous name. Felix (1883) re-examined some of Goeppert's original *Kloedenia* material, provided a full description, and used a new combination, *Quercinium primaevum*, which is invalid, since the earlier name for this material, *K. quercoides* Goepp., was validly published. The valid name for this species remains *Kloedenia quercoides* Goepp. If this be accepted into the organ-genus diagnosed above, the name *Quercinium* should, according to the International Code, be abandoned in favour of *Kloedenia*. This latter name has been used only once and has

---

EXPLANATION OF PLATE 21

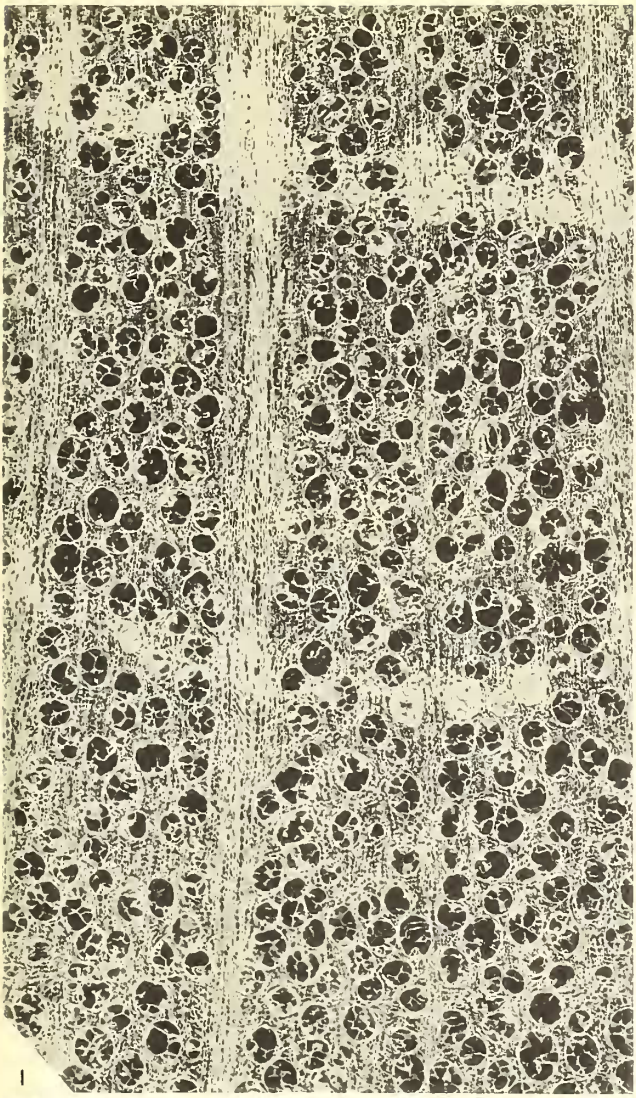
Figs. 1, 2. *Q. porosum.* 1, Transverse section of secondary wood showing the close arrangement of the large vessels, the broad rays, and absence of growth rings. ×16. The two light areas are caused by a dark gum-like infiltration of the tissue. 2, As fig. 1, but showing origin of a broad ray by aggregation of fine rays and elimination of the intervening tracheary tissue. ×37.

Figs. 3, 4. *Q. pasanioides.* 3, Transverse section for comparison with fig. 1. The vessels are arranged in radial strings, and the banded parenchyma shows as light, wavy lines. Tangential compression during fossilization has reduced the tangential diameter of most of the vessels here. ×16. 4, Transverse section of a radial cluster of vessels accompanied by vasicentric tracheids. The tangential bands of parenchyma are visibly differentiated from the fibres of the ground tissue, as are the numerous fine rays. ×37.

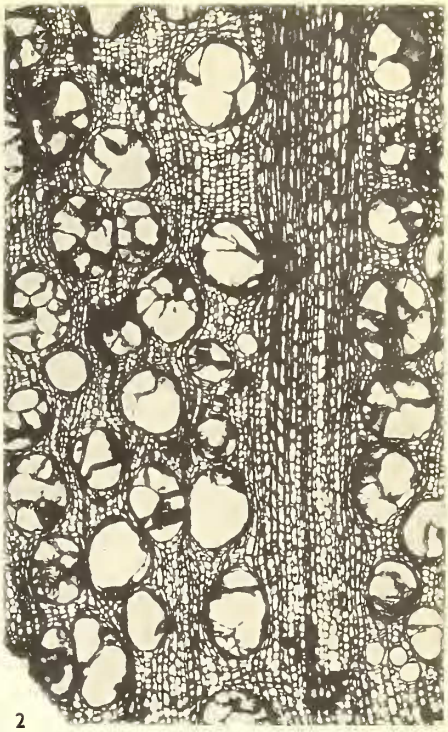
EXPLANATION OF PLATE 22

Figs. 5, 6, 11. *Q. porosum.* 5, Radial section. Part of a broad ray is shown on the left, and to the right of centre some intervascular pitting of a vessel. Tyloses fill the vessels and wood parenchyma is abundantly represented. ×50. 6, Tangential section, showing part of a broad vertically compound ray of some twelve cells in width, and uniseriate rays. ×50. 11, Radial section, part of a vessel with tyloses and ray cells showing the simple, elongated pits to the vessel. ×135.

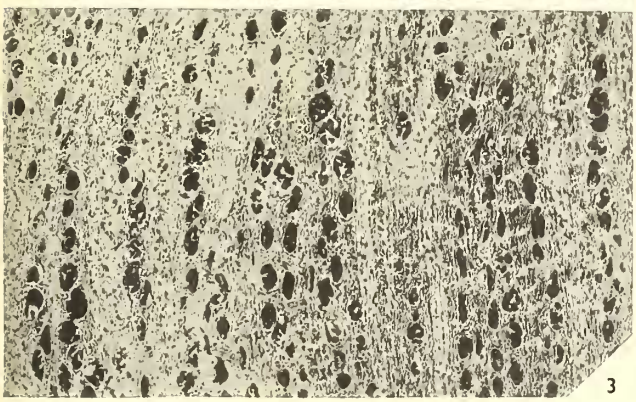
Figs. 7–10. *Q. pasanioides.* 7, Tangential section, showing uniseriate rays and a broad ray with fibrous inclusions. ×50. 8, Radial section to show appearance of the regularly banded wood parenchyma; some chambered crystalliferous cells are visible in the strand to the left of centre. ×50. 9, Radial section, to show ray to vessel pitting of elongated simple pits; small, bordered pits of the fibre-tracheids are also shown. ×135. 10, Radial section, showing the richly pitted walls of the ray cells ×135.



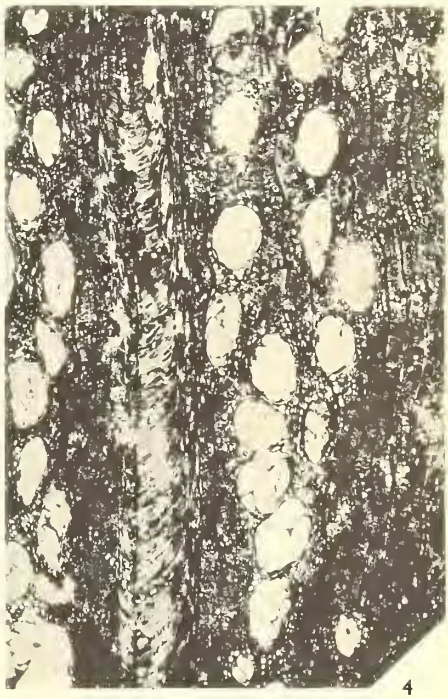
1



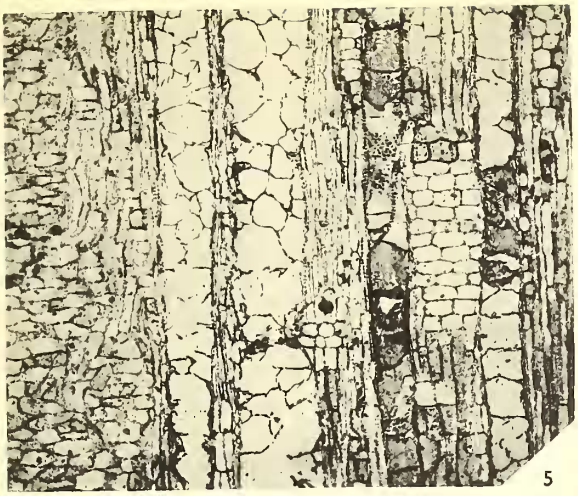
2



3

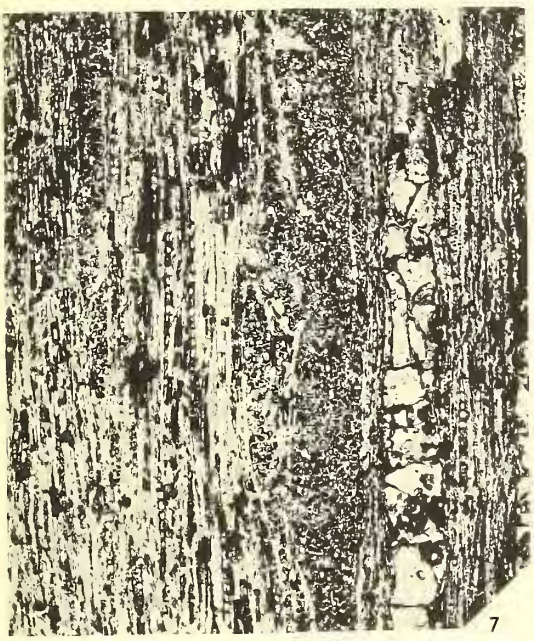


4



5

6



7

8

9

10

11

BRETT, *Quercinium*